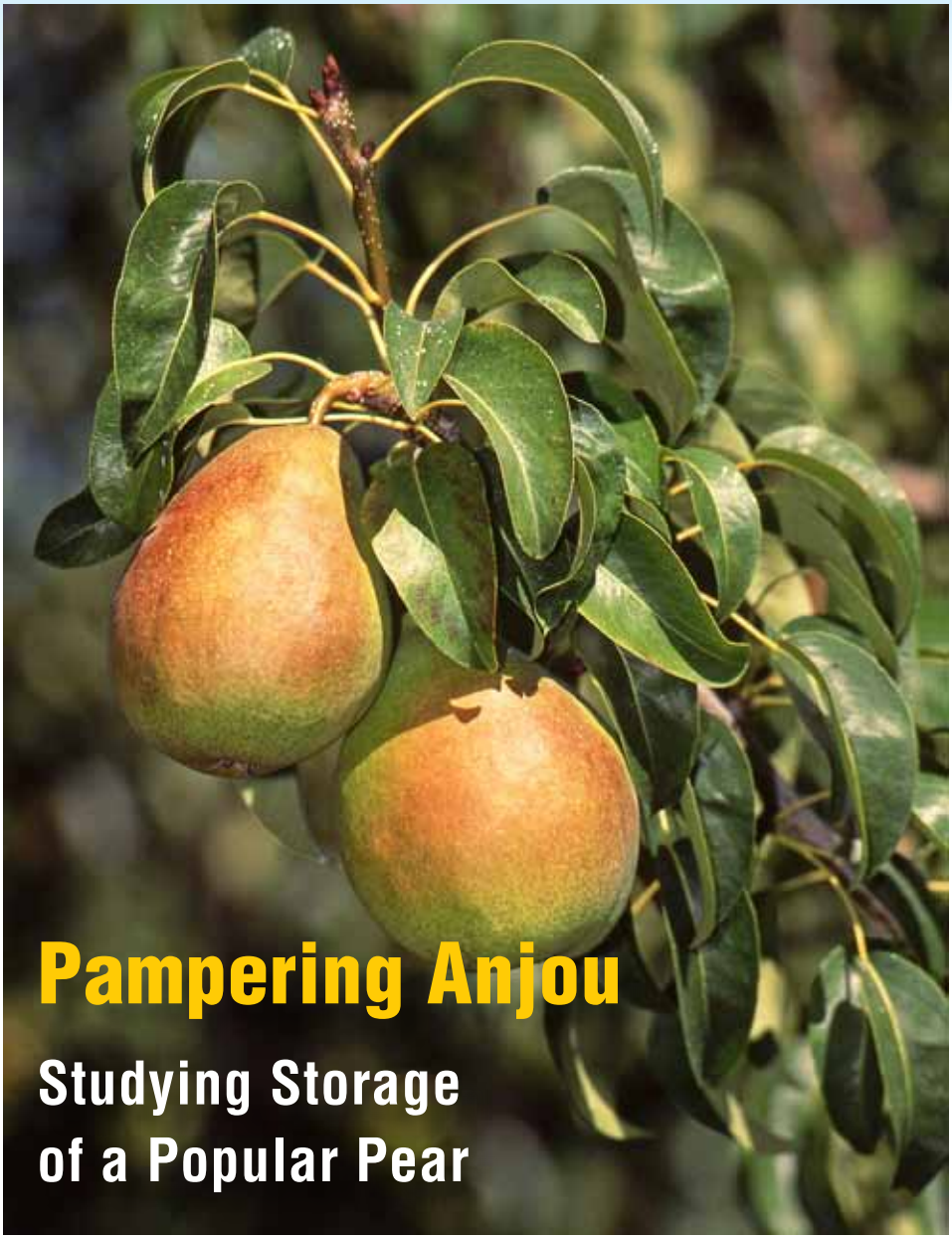
DOUG WILSON (K4315-13)



Anjou pears like these don't ripen on the tree. Commercially grown Anjou pears are ripened and stored indoors with the use of science-based technologies.

Pampering Anjou

Studying Storage of a Popular Pear

No wonder the Anjou is one of America's favorite pears. When properly ripened, this chubby fruit is sweet and juicy, with a pleasing, buttery-smooth texture.

In the United States, Anjou (also called d'Anjou) pears are grown commercially in Washington and Oregon, where they are harvested in late summer. Thanks to storage technologies that postpone ripening, the pears are usually available through the following spring at the produce section of your local supermarket.

Long-term storage of this highly perishable fruit typically involves keeping it in sealed storerooms in which the chilled air is low in oxygen. This refrigerated, "controlled atmosphere" environment slows the fruit's respiration and helps keep some storage-associated diseases at arm's length.

But the Anjou is not always an easy pear to store. The pears can develop storage-related diseases, or other problems, such as internal or external browning. Or, once taken out of storage, they can sometimes be annoyingly slow to ripen.

In Washington's Wenatchee Valley, one of the nation's premier pear-growing regions, Agricultural Research Service plant physiologist Jim Mattheis and colleagues conduct studies that are designed to help growers and packers sidestep these and other storage-associated problems.

I-MCP and the Anjou

In a series of Anjou-focused studies that began in 1998, Mattheis and colleagues investigated the use of a compound, 1-MCP (methylcyclopropene). Their intent? To see how well this compound could delay ripening. Ideally, delayed ripening prolongs storage life—without lessening the pears' ability to ripen on demand later on.

1-MCP has been used in this country since 2002 to extend storage of apples. Mattheis's team, however, is the first to document, in a peer-reviewed scientific journal, its use on Anjou pears kept in refrigerated storage for up to 8 months.

The team's article, published in the *Journal of Agricultural and Food Chemistry* in 2003, indicated that results were mixed. On the positive side, the team found that applying 1-MCP, as a gas, at 100 parts per billion—a level approved as safe for food use—prolonged refrigerated storage of the pears as compared to that of untreated, refrigerated pears.

What's more, the 1-MCP treatment resulted in significantly less superficial scald and pithy brown core. Superficial scald is characterized by a dark-brown discoloration of the skin, which makes the pear unmarketable. Pithy brown core, as its name implies, discolors the pear near its core and changes the pear's texture from delectable to unpleasantly fibrous.

In addition, the research suggested that the treatment might provide an alternative to ethoxyquin, which is used today to control scald on Anjou. An ethoxyquin alternative would be useful for exports if the European Union decides, at some point, to ban the compound.

Another plus: applying 1-MCP may have the potential to enable packers to store Anjou pears in regular air (the air we breathe), with refrigeration, instead of in controlled atmospheres. "Pears stored in air in our 1-MCP study had delayed ripening and no scald or pithy brown core," says Mattheis. Cutting controlled atmosphere out of the storage picture, by using air instead, might

reduce storage costs and perhaps have environmental benefits, as well.

But the study also showed that when the 1-MCP-treated pears were taken out of cold storage and exposed to ethylene—a natural compound that triggers ripening—the warmth and the ethylene did not consistently or predictably initiate ripening. The resulting delays in ripening can be frustrating, disruptive, and costly for packers and buyers alike.

The 2003 study has paved the way for follow-up experiments, in which the Wenatchee scientists are examining various combinations of 1-MCP application rate; storage duration, temperature, and regimen (controlled atmosphere or air); and post-storage temperature. This work "has shown promise in promoting consistent Anjou ripening after storage," Mattheis says. In the meantime, about 5 to 10 percent of Pacific Northwest-grown pears are being treated with 1-MCP.

Monitoring Chlorophyll Fluorescence: Not Well-Suited to Anjou?

Standard controlled atmosphere provides pears with 1.5 to 2 percent oxygen. Storing scald-sensitive fruit, such as Anjou pears, in very-low-oxygen concentrations—that is, below 1 percent—tends to prevent scald, says Mattheis. However, these very low concentrations may present other risks to the pear's quality, such as development of off-flavors or black speck—an unwanted speckling of the pear's skin.

With these risks and benefits in mind, the team explored the potential of using chlorophyll fluorescence monitoring as an "early warning system" of increased risk of low-oxygen-associated problems in stored Anjou pears. With stored apples, an increase in fluorescence levels of the chlorophyll in the peel apparently correlates well with increased risk of low-oxygen-linked problems. So, when apple chlorophyll fluorescence levels go up during very-low-oxygen storage, storehouse managers raise the oxygen level slightly to prevent damage to the fruit.

Use of the technology for keeping an eye on stored apples and pears is still relatively new, and very little research data about its applicability to Anjou has been published. Mattheis and co-workers have helped fill in the knowledge gap by conducting preliminary tests of Anjou pears stored at the conventional 1.5 percent oxygen or at extremely low levels of 0.5 or 0.4 percent.

With Anjou, fluorescence levels did not warn of the development of disorders. For instance, black speck and pithy brown core developed with no detectable changes in the pears' chlorophyll fluorescence levels.

These and other findings are documented in articles published in 2010 and 2013 in *Postharvest Biology and Technology.*

"For now," says Mattheis, "we advise packers to use caution before relying on chlorophyll fluorescence for monitoring stored Anjou pears in very-low-oxygen conditions."

Mattheis collaborated in the research with Wenatchee plant physiologist David Rudell; former postdoctoral research associates Xuetong Fan (now with ARS in Wyndmoor, Pennsylvania), Luiz Argenta, and David Felicetti; industry colleague Nate Reed; and former Oregon State University researcher Jin Bai, today with ARS at Fort Pierce, Florida.—By **Marcia Wood,** ARS.

This research is part of Quality and Utilization of Agricultural Products, an ARS national program (#306) described at www.nps.ars.usda.gov.

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Fresh pears add flavor, fiber, vitamin C, and more to a hearty oatmeal.

IMAGE COURTESY OF PEAR BUREAU NORTHWEST (D3096-1)